







## Interaction with indicator

Two simple linear regression models with the normal errors with common variance.



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Two simple linear regression models with the normal errors with common variance  $\sigma^2$ .

$$Y = a_1 + b_1X + \epsilon, \quad i = 1, \dots, n \quad (1)$$

$$Y = a_2 + b_2X + \epsilon, \quad j = n + 1, \dots, n + m \quad (2)$$

Trend changes

$$Y = a_1 + b_1X + \epsilon, \quad \text{for } X < x_0$$

$$Y = a_2 + b_2X + \epsilon, \quad \text{for } X \geq x_0$$

Some problems call for alternative models than regression.

Which grad school is the best?

Which treatment is better? (Program A, B, C)

What dosage level (low, medium, high) is most effective?

What is the best treatment combination to manufacture a product?

## Math form

$$E(Y|X) = \mu_0 + \beta_1 X_1 + \beta_2 X_2$$

$$E(Y|A, B) = \mu + \beta A + \beta B$$

### Qualitative vs. Quantitative

Picture (Figure 16.1, KNNL)

Factor, Factor Level ("Value" of the factor)

Spectrum from Quantitative–Qualitative variables. Categorical Variables.

Single factor versus Multifactor





